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Chong et al.

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[54] **LOW-LOSS, FAIR BANDWIDTH
 ALLOCATION FLOW CONTROL IN A
 PACKET SWITCH**

5,619,500 4/1997 Hickali 370/414
 5,649,299 7/1997 Battin et al. 455/62
 5,757,801 5/1998 Arimilli 370/444

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 154(a)(2).

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[52] U.S. Cl. **709/235; 709/234; 709/207;
 709/231; 709/233; 370/414; 370/444**

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[56] **References Cited**

U.S. PATENT DOCUMENTS

4,953,157	8/1990	Franklin et al.	370/230
4,970,720	11/1990	Esaki	370/416
5,193,090	3/1993	Filipiak et al.	370/440
5,345,600	9/1994	Davidson	455/501
5,381,413	1/1995	Tobagi et al.	370/448
5,434,848	7/1995	Chimento, Jr. et al.	370/232
5,546,389	8/1996	Wippenbeck et al.	370/412
5,555,264	9/1996	Sallberg et al.	370/414

[57] ABSTRACT

In a switch fabric environment, which includes a buffer, packet data of different class-types from different sources is received, stored in the buffer, processed and outputted to its intended destination. As the buffer fills up, transmission from some of the data sources is stopped to avoid dropping of packets. To avoid packet loss, when the occupancy of the buffer reaches a first threshold value, further transmission of a first-class type of data is precluded from the particular source of that data then being received, while transmission from other sources of that same first-class type of data is not precluded from these other data sources until first-class type of data from such other sources is also received. Further, data of a second-class type is not precluded from being transmitted as long as the amount of data stored in the buffer remains below a second threshold, which is greater than the first threshold. When the occupancy of the buffer reaches that second threshold, further transmissions from the particular source of that second-class type of data then being received is also precluded. As data from other sources of that second-class type of data is received, further transmissions from those other sources are also precluded. A third-class type of data, however, is not precluded from transmission as long as the amount of data remains below a third threshold value, which is greater than the second threshold value. In order to avoid packet loss, when a packet from any source is received, it is stored regardless of whether transmission from the source of that packet has been precluded. Advantageously, a MAX/MIN distribution of the available bandwidth can be probabilistically achieved without packet loss.

11 Claims, 17 Drawing Sheets

